Norwegian word accents & the mental lexicon: 2 psycholinguistic experiments

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Introduction

Amongst the North Germanic languages most dialects have tonal word accent opposition, i.e. words can differ by means of tonal melody alone, e.g. *aksel*$_1$ 'shoulder' *aksel*$_2$ 'axle'. There are two tonal melodies referred to as *acute/grave* or Accent 1 (A1)/ Accent 2 (A2). Dialects differ in their manifestation of the tonal accents and some in fact have no tonal opposition at all. However, dialects are in general mutually intelligible, thus these prosodic differences do not seem to present large barriers for understanding. Are they indeed at all important for word recognition?

Research questions:

1. Is tonal information important for word recognition or does segmental information alone suffice?

2. Will the lexical specification of tone be reflected in word retrieval, i.e. in response accuracy and speed?

Lexical specification:

There are two privative hypotheses assuming that one accent is lexically specified and the other is default or follows rules: lexical Accent 1 hypothesis (e.g. Lahiri, Wetterlin & Jönsson-Steiner 2005; Kristoffersen 2006, 2007; Wetterlin 2010) and lexical Accent 2 hypothesis (e.g. Rischel 1963, Riad 1998, 2009).

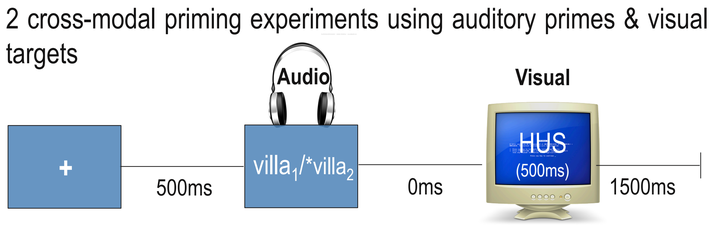
Predictions:

If tonal information is just as important as segments, words with the wrong accent should not prime. If tonal information is stored in the mental lexicon, lexical accent should assist in word retrieval. We predict faster reaction times and greater precision for one accent (lexical) as opposed to the other accent (default).

Methods

Stimuli & Experimental Design

2 cross-modal priming experiments using auditory primes & visual targets



Experiment 1: Semantic priming with lexical decision task

72 real-word targets with 72 semantically related primes (36 Accent-1 prime pairs: correct & incorrect accent; 36 Accent-2 prime pairs: correct & incorrect accent) with matching-accent control prime pairs (correct & incorrect accent). 72 nonword targets with same numbers and patterns of words as for real-word targets.

Real-word target set:

Accent 1		
Condition	Prime	Target
A1 semantically related prime	**villa**$_1$ 'villa'	**HUS** 'house'
Same prime (opposite accent)	***villa**$_2$	
A1 unrelated control	**mango**$_1$ 'mango'	
Same control (opposite accent)	***mango**$_2$	
Accent 2		
Condition	Prime	Target
A2 semantically related prime	**humle**$_2$ 'bumblebee'	**BIE** 'bee'
Same prime (opposite accent)	***humle**$_1$	
A2 unrelated control	**panne**$_2$ 'pan/forehead'	
Same control (opposite accent)	***panne**$_1$	

Experiment 2: Form priming with lexical decision task

Same auditory primes used as in Experiment 1 with 72 real-word targets and 72 form related primes (36 Accent-1 prime pairs: correct & incorrect accent; 36 Accent-2 prime pairs: correct & incorrect accent) with matching-accent unrelated prime pairs (correct & incorrect accent). 72 nonword targets with same numbers and pattern of words as for real-word targets.

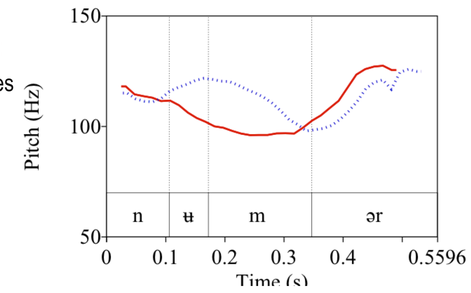
Experiment 2: real-word target set

Accent 1		
Condition	Prime	Target
A1 identity (word)	**villa**$_1$	**VILLA**
Same prime (opposite accent)	***villa**$_2$	
A1 unrelated control	**mango**$_1$	
Same control (opposite accent)	***mango**$_2$	
Accent 2		
Condition	Prime	Target
A2 identity (word)	**humle**$_2$	**HUMLE**
Same prime (opposite accent)	***humle**$_1$	
A2 unrelated control	**panne**$_2$	
Same control (opposite accent)	***panne**$_1$	

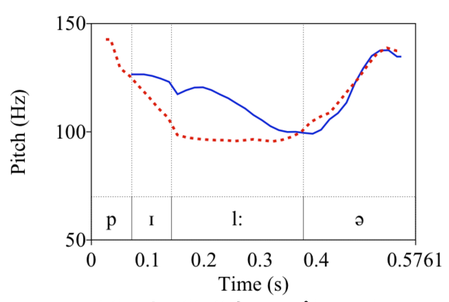
All primes are disyllabic Norwegian nouns. Both sets of primes (Acent 1 & Accent 2) were controlled to ensure that they had similar mean frequencies. Targets were also controlled for frequency, number of syllables and letters.

Example of tonal contours of primes:

Accent 1 prime:
(dashed line indicates opposite accent)



Accent 2 prime:
(dashed line indicates opposite accent)



Both experiments were run at the Institutt for språk- og kommunikasjonsstudier at the NTNU, Trondheim Norway.

Participants: 64 native speakers of the Trondheim or of a similar dialect from a nearby community (Average age: 25).

Results

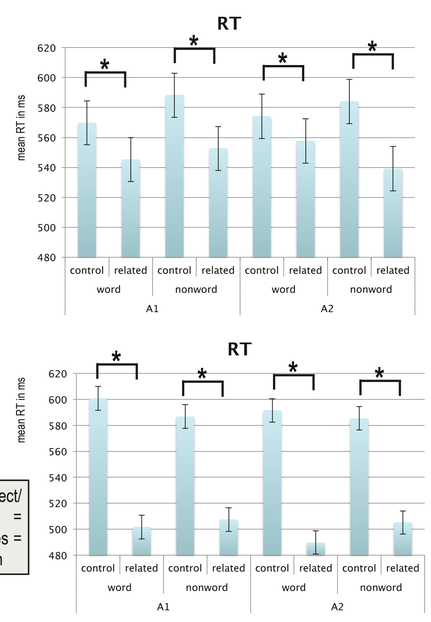
***Reaction times:* (mean RTs in milliseconds)**

Experiment 1
(semantic priming)

RT stats were calculated using a LMM design (subjects & items random)

Experiment 2
(form priming)

key: nonwords = words with incorrect/ opposite accent; asterisk = significance ($p < 0.05$); vertical lines = standard error of means of condition

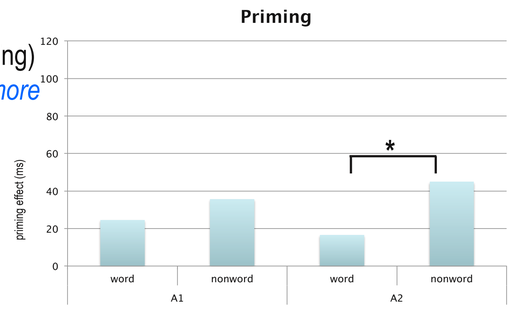


Priming: When participants heard related primes with correct or incorrect accent they were faster to react to the targets than when hearing unrelated control words (with correct/incorrect accent) in both semantic and form priming experiments.

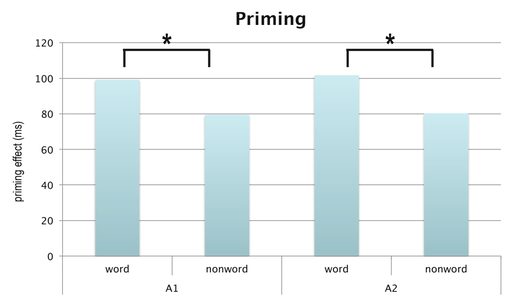
Reaction times (cont.)

Priming effects: (control minus test (related))

Experiment 1
(semantic priming)
higher bars = more priming



Experiment 2
(form priming)



Both priming experiments: regardless of tonal information, related words/nonwords prime significantly better than unrelated controls.

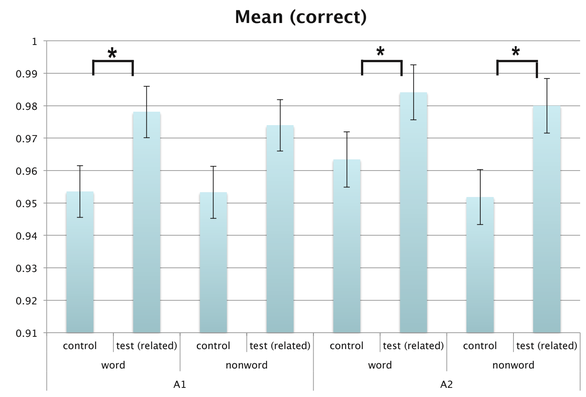
Semantic priming: the significance found between A2 words and *NWs indicates that A2 *NWs prime better than A1 *NWs

Form priming: Related words with correct accent prime significantly better than those with incorrect accent.

Error analysis

Error analysis done using a logit generalised linear model with a binomial distribution

Experiment 1
(semantic priming)



More errors were made when hearing semantically unrelated controls than when hearing semantically related words. Accent-1 words had the least percentage of errors.

A comparison of the % of errors made when hearing unrelated controls to those made when hearing the related test primes indicate that all related primes differed from the controls except for A1 nonwords. The percentage of errors here was just the same as when hearing unrelated controls.

Discussion

Tonal and segmental information

The semantic and to an even greater extent the form priming experiments both show that segmental information is enough to activate the semantics (Ex1) and the phonology (Ex2) of the targets. Changing the accent did not throw participants off. Words with the wrong/opposite accent still activate the semantic or form-related primes — matching segments suffice. This comes as no surprise since there are dialects that have lost the tonal contrast entirely and speakers of dialects with opposite tonal manifestation for the accents still understand each other.

The significant difference in priming found for A2 NWs and A1 NW error rates hint at the representation of tonal information. Both the fact that A2 NWs prime better than A1 NWs and that A1 NWs were similar to controls in their error rates, indicate that tonal information is stored for A1 but not for A2. It was easier to accept a different tonal contour for A2 words since no tonal information is stored — RTs were thus faster. For error rates, controls had overall more errors than related primes, and wrong tonal information when accessing A1 words throws the listener off and they made just as many errors as with controls.

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Selected References

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